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EMBEDDEDNESS CONFIGURATION AND ITS' RELATIONS TO INTER-FIRM CONNECTIVITY IN SUPPLY NETWORK: A SOCIAL NETWORK ANALYSIS APPROACH

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Abstract:
This is a network exploratory research looking at determining the different pattern of connectivity that may exist in a buyer supplier relationship of the supply network and how these differences affects the pattern of inter-firm positioning in the network. Specifically, to address the lack of theoretical work on how connections in the supply network influence supply network outcome, this research examines how different buyer-supplier embeddedness configuration in the different type of buyer supplier network relations pertains to the different pattern of connectivity that may exist in a buyer supplier relationship of the supply network. This research adopted the social network analysis methodology from the field of sociology. Findings showed that the embeddedness configuration of firms differ depending on the type of network relations. Future research should attempt to conduct statistical test of the relationship posted in this study.

Keywords:
Container Supply Network, Embeddedness, Relational Capital, Supply Chain, Social Network Analysis

1. Introduction
It is argued that firms' involvement in broader social structure construes relational capital and can have a positive impact on the outcomes of the firms (Portes, 1998; Cao Cao, Simsek,and Jansen, 2015). Relational capital is a concept that is being increasingly adopted in public policy, organizational study and more recently operation and supply chain research (Baron, Field and Schuller, 2000; Dakhli and De Clercq, 2004; Landry, Amara and Lamari, 2002; 2005, Osman 2015;2017). Its' importance to the performance of a firm embedded in a supply network is paramount (Choi 2006, 2018). The concept has been applied to elucidate and forecast different phenomena such as industrial districts (Gordon, Kogut and Shan, 1997; Reagans, Ray and McEvily, 2003; Walker, Kogut and Shan, 1997) emerging market (Halaszovich and Lundan, 2016). and across a country (Dakhli and De Clercq, 2004). At the same time, firms have recognized that their continuous pursuit of relational capital is often impeded by their lack of understanding its own network structure and its degree of network involvement (Osman, 2017). This is understood as both have yet to be elucidated by researchers in the field of operation management (Wu and Pullman, 2015). Issues regarding the suitable methodology and process contributed to the paucity of research. We extend this research by exploring how the different pattern of embeddedness configuration that firm may possessed in buyer-supplier relationship influences the ways in which the buyer and supplier may acquire their level of relational capital outcomes.

The relational capital has been metaphorically described in network literature as structure of connectivity (Ozdemir et. al. 2016). Some firms are connected to others in their environment. Being connected to others increases trust between them and subsequently obligate the linked firms to support their partners. In this condition, firms are dependent on exchange with their joined partners. Occupying a certain position the structure of these exchanges is by itself an invaluable asset to the particular firms. That asset is what is referred as relational capital, in essence, a concept of location impacts in varied market conditions. Thus, the relational capital dimension is defined in this study as the form of capital emerged through connectivity structures or its embeddedness configurations that can

create for certain actors a competitive advantage in pursuing their goals or objectives (Tregear, and Cooper, 2016; Laud, et.al. 2015) .

In this research we frame the relational capital dimensions as the embeddedness configuration. Framing the relational capital dimensions as the embeddedness configuration is necessary because while the quality of relationships matter, the intensity, quantity and organization of firms' interactions also influence behaviour in the supply network (Kim, 2015). Therefore, we consider the embeddedness configuration to represent the intensity and organization of supply network structure connectivity.

Choi and Kim (2001) present the initial platform for operations and supply chain management researchers to adopt the embeddedness configuration concept into the supply of supply input in the supply network. Using the Social Network approach, the authors present the embeddedness concept from the perspective of the supply chain. The authors posit the importance of framing organizations in the supply network (i.e. suppliers) as being embedded in a larger supply network than in isolation. Such framing provides organizations in the supply network with better basis in developing policies and long-term strategies. The authors went on to posit that the embeddedness configuration of organizations in the supply network influence its performance, a statement in tandem with previous network research findings that found the configuration of network of relations can facilitate or impede an organization's behaviours and performance (Granovetter, 1985; Burt, 1992; Nohria, 1992).

Although, Choi and Kim (2001) article illuminate the essence of embeddedness in the supply network and its impact on the organization in the supply network, it did not describe the type of social network relationship that influences the degree of embeddedness of organization in the supply network and how these resulting embeddedness configuration would impact on the overall performance of the organizations in the supply network (Osman, 2013). As many Social Network analysts would argue, network is resulting from the various social interactions or inter-organizational relationship that took place between the actors (i.e. organizations) that reside in it.

Economic action is embedded in networks of relations (Granovetter, 1985). If economic action is embedded in networks of relations, then a logical first step is to specify the dimensions of embeddedness configuration and the relations by which they influence economic action. This undertaking builds on the work of others who have launched the important enterprise of reintroducing social structure into the analysis of economic phenomena. In trying to demonstrate the unique organizational and market processes that follow from an understanding of social structure and economic performance, this research analysed the properties of embeddedness configuration and how they pertain to the network relations of both formal and informal in nature.
Thus, this research argue that where a firm is positioned in a supply network structure its different type of network relations will influence its embeddedness configuration thus consequently, the performance of the firm. This research did not attempt to determine the correlation between embeddedness configurations with performance as it has been proven by many earlier studies (Granovetter, 1985; Burt, 1992; Nohria 1992; Choi 2001). This research will attempt to elucidate, the degree of relational capital dimensions or embeddedness configuration in a formal supply network relationship such as contractual relationship versus informal supply network relationship may differ between the two. The research question that drives this study is:

Research Question: How are the variations in embeddedness configuration associated with different kinds of supply network relations?

2. Literature Review Or Research Background

2.1 Embeddedness

We conceptualized embeddedness configuration using the social network analysis and the embeddedness literature. According to Granovetter (1985), embeddedness refers to the level of involvement of a firm in the network of inter-relations. A firm's levels of involvement have an impact upon its actions or behaviour in the network. Granovetter (1985) advanced the concept of embeddedness as an effort by which to explain economic behaviour of an organization.

Embeddedness configuration is based on the contextualization of economic activity in ongoing patterns of social relations and captures the contingent nature of an economic actor's activities by the virtue of being embedded in a larger social structure (Granovetter, 1985; Simsek,and Jansen, 2015). More specifically, economic decisions and outcomes are affected not only by the actor's isolated relations with other individuals or firms in the network but also by the structure of the overall network of relations within which the actor resides i.e. its embeddeness configuration. Economic behaviours are embedded in the network of relations that provide the context for economic processes (Granovetter, 1985; Ozdemir et. al. 2016). As every behaviour materializes through some form of outcome, almost all economic processes are presumed to be embedded in the networks of relations thus leading to the emergence of embeddedness configuration. Consequently, because embeddedness configuration is the result of firms' economic behaviour, it is safe to posit that organizational performance is influenced by the pattern of embeddedness of the organization in the network.

Since in the supply network, firm embeddedness relate to the degree of the interaction that a firm may has with other firms in the network which are a direct reflection of the firm degree of inter connectivity with others in a network. Hence, one may conclude that organization performance in the supply network may also be influenced by the organization embeddedness configuration which may include parameters such as its centrality and connection (Scott, 1998) with other organizations in the supply network (Mueller, 2000).

2.2 Network Relationships

Being embedded in a supply network structure is an indication of interaction among firms in a supply network structure (Tregear, and Cooper, 2016). The resulting pattern of actors' embeddedness configuration creates a network of interdependent social exchanges, and subsequently increasing the level of trust, reputation and respect present in the relationships. Certain actors of the network may then emerge as trusted exchange partners who may come to assist in time of needs (Ahuja, 2000; Cousins et al., 2006). While this approach may have been widely applied and recognized in the individual and intra-organizational literature (Gnyawali and Madhavan, 2001; Gulati, 1998; Moran, 2005; Simsek, Lubatkin and Floyd, 2003; Uzzi, 1997), the central role of embeddedness in larger structure such as the supply network is often overlooked (Yeniyurt, and Carnovale, 2017).

Furthermore, although previous studies have confirmed that embeddedness configuration materialized in network relationships, these findings were centred in the context of a decentralised network structure. However, the embeddedness configuration in a centralized network structure remains unknown.

2.3 Embeddedness Configuration: Centrality

In this study, an element of embeddeness configuration that will become the focus of this research will be the centrality. Centrality relates to the coreness of a firm position in a network of inter-firm relationships (Freeman, 1979). By coreness is meant central location of the firms in the network. Network analysts relate centrality with control and power as function of certain relational characteristics (Hanneman and Riddle, 2005). Centrality can be measured as characteristics of the overall network in which it is called centralization. Centrality can also be measured at the actor level property. Centralization index ranges from 0 to 1, provides a measure of variation around a central tendency, similarly to the standard deviation (Knoke and Kuklinski, 1982; Knoke and Yang, 2008). Three measures of centralization are commonly applied in the social network research are the degree centrality, closeness centrality and betweeness centrality.

In this study, the researcher adopted degree centrality centrality measures by which to illustrate firms' centrality in the centralized upstream supply network structure. Degree centrality measures the number of other firms in the centralized upstream supply network to which a firm is tied (Freeman, 1979; Wasserman and Faust, 1994; Scott, 1998).

2.4 Embeddedness Configuration and Network Relationship

Multiple and extensive interactions generate relational capital among firms. For example, Uzzi (1997) found that, in order to obtain information regarding a potential partner before collaboration activities can be carried out; firms resort to close firms for information. The embeddesness configuration between the firms, argued Uzzi (1997) and Geels, (2014) is the result of multiple exchanges in the past. In the same vein, Geels, (2014) highlighted that years of multiple inter-firm relationships generate dense embeddedness configuration among them. In addition to that, Gulati and Gargiulo (1999) found that negative gossip by third parties about another party's uncooperative behaviour significantly reduces the likelihood of direct relations; whereas positive gossip strengthens the likelihood of direct relations among firms in the network. What this literature shows is that extensive interactions are a catalyst for relational capital or embeddedness configuration in networks of inter-firm relations (Yeniyurt, and Carnovale, 2017).

Thus, the literature indicates that firms in a network having a multiple and extensive relationship with other firms in the network may be perceived as trustworthy by others. Since multiple and extensive relationships in network analysis can be pictured based on the level of firms' centrality in the network structure, this thesis hypothesizes that:

Proposition: Firms' embeddedness configuration following their degree centrality position in the centralized supply network is subject to the type of inter firm relations.
Subheadings are italicized and left-aligned

3. Methodology

This research follows the exploratory and statistical social network analysis approach found in literature studies in order to determine how the impact of firms' embeddedness in the centralized upstream supply network impacts upon the firms' relational capital outcomes. In this section, the researcher briefly discusses and justifies the adoption of the SNA methodology. This research follows the exploratory and quantitative social network analysis approach found in the literature in order to determine how firms' relational capital outcomes are affected by their embeddededness in the supply network structure.

In a Social Network Analysis (SNA) study, the relationships or ties between the actors in the network are the primary data collected while the actor attributes or characteristics serve as the secondary data. This is the unit of analysis of the study. Social network analysis adopted both statistical and graphical methods to elucidate the relational and attribute data of the network members. The survey questionnaire consisted of closed-ended questions and open-ended questions. It begins by asking general questions and is followed by more specific and probing questions. In general, the questionnaire was framed following the standard of Choi and Hong (2002), Provan and Milward (1995), Stone (2001), Corteville and Sun (2009) and Cross and Parker (2004) respectively.

Structuring of network of relations has an important implication for actors of the various networks (Knoke and Yang, 1998). Given a collection of actors, a social network analysis can be used to study the structural variables measured on actors in the respective network. These structures involve the pattern of ties between the actors. A network analyst would seek to model these ties to depict the structure of a group. One could then investigate the impact of these structures on the functioning of the network or the influence of these structures on actors embedded within these network structures (Hanneman and Riddle, 2005).

Investigation of the implication of these structures upon the embedded firms requires a method that can analyse not only the characteristics of the actors, but also the relations between the firms that form the structures. Wasserman and Faust (1994) documented that the unit of analysis in network study is not just the actor, but consists of an entity made up from the collection of the actors and the linkages among them. An actor of the network, stressed Knoke and Kuklinski (1982) can be an individual, a team or even organisations. Consequently, the unit of analysis of this study comprises the relationships between the firms and the attributes of firms of the APMMHQ-1 upstream supply network.

In addition, Wasserman and Faust (1994) as well as Lusher (2000) argued that the typical statistical method and analysis are not adept at measuring relations. One important fact behind this argument is that standard statistical analyses disavow the existence of relationships between firms in a network through the assumption of independence of observation. However, the network approach, more specifically the Social Network Analysis (SNA), focuses on the relations between firms and the pattern of the relations and the implication of the relationships (Wasserman and Faust, 1994).

For the purposes of this study, a centralized upstream supply network of a small maritime industry seemed to be an ideal setting. A supply network in the maritime industry is a material-intensive enterprise. Much of the activity is highly dynamic and is widely dispersed throughout the network. The flow of materials and information is transferred through interactions among different firms. Because firms in a supply network operate in an environment having a high degree of complexity (Bozarth et al., 2009) and uncertainty (Wilding, 1998), these firms seek an edge through connections or interactions with members of the network. Lambert and Cooper (2000) stated that the key to these issues is the on-going relationship with other partners. They stressed the importance of investigating the relationships that suppliers and customers have. Johnston et al., (2004) suggested that on-going relationships among members of the supply network increase efficiency and effectiveness of the supply network.

The focal research site of this study is located in the Peninsular Malaysian cluster. The network, labeled here as APMMHQ-1, is part of the centralized upstream supply network. APMMHQ-1 is a company in the Malaysian shipbuilding industry involved in ship repairs, maritime, engineering and related service provider matters. To date, the company has awarded contracts to local vendors and suppliers totaling RM 31 million for the development of small vessels in the region. Recently, the company invested RM 100 million to create new facilities in different locations across Malaysia to develop and service small vessels in the country. Efforts are being undertaken to determine partners for the operations. APMMHQ-1 has also crafted a vendor development program to work with the small and medium enterprises, attracting some firms to supply SBSR products and services.

APMMHQ-1's centralized upstream supply network was considered to be one of the best supply systems in the region through its Integrated Logistic Support (ILS) programs. Top level management was approached for possible participation in the study. After several communications about the goal of this study and the potentials' benefits for the APMMHQ-1 supply network, positive commitments were received from the top management to participate in and grant participation for this study.

In network studies, all the actors who are located within the naturally-occurring boundaries are included for analysis. Consequently, network studies do not use samples as in the conventional sense; rather, it seeks to include all the actors in some population or populations (Hanneman and Riddle, 2005). As such, the research population for this study consists of all the supplier firms in the centralized upstream supply network of APMMHQ-1. More specifically, this study investigates the firms operating in the upstream supply network of APMMHQ-1 relating to the supply of parts and materials for the production of Rigid Hull Inflatable Boat (RHIB) to the APMMHQ-1. In APMMHQ-1 production, the RHIB is a small, fast craft that received the highest demand from the market. Thereby, the upstream supply network for the RHIB product is one of the most active networks of firms in the APMMHQ-1 vast supply network variety. Data analysis was performed using the Social Network Analysis software i.e. the UCINET and NetDraw.

4. Results And Discussion

4.1 Visual Analysis Firm Embeddedness Configuration and Degree Centrality

In this section, for the analysis of the effects of firms' embeddedness configuration based on degree centrality, the researcher will first present the network maps of the network structure. This network map was developed is developed as the sociogram of the supply network. The result involves firm measures of network embeddedness configuration, i.e.: degree centrality in contract tie, information-sharing tie, referral made tie and referral received tie. This was carried using the program NetDraw in generating the network map for supply network that includes the

firms' embeddedness attributes based on the degree centrality scores across all four ties. This will generate four network maps of supply network, which display the level of embeddedness configuration of firms in the network indicated by the size of the nodes in the maps. Using these attribute data, the researcher developed four sociograms of the network, i.e., contract tie, information-sharing tie, referral made tie and referral received tie. Figures 1, 2, 3 and 4 depict the network with node attributes measured based on degree centrality in four supply ties, i.e., the contract tie, information-sharing tie, referral made ties and referral received tie.

The sociograms in Figures 1, 2, 3 and 4 incorporated the firms' measures of network embeddedness configuration (degree centrality) of each of the firm's level of tier in the network. In each of the figures, nodes or firms are colored based on the nodes' level of tier as reported by other network members. Tier is the position that the firm occupy in the flow of materials in the supply network. For example, firm in tier lowest supply to firm in medium tier. Firms in medium tier level supply to firms in highest. Red square means the firm is in highest tier; green is medium tier and blue is lowest tier in the network. The rating for tier is based on flow of supply, as nominated by other firms in the APMMHQ-1 upstream supply network structure. Furthermore, the squares that represent the nodes or firms are in different sizes, which correspond to the level of embeddedness configuration measured based on degree centrality. Thus the bigger the size of the square of firm in the network structure, the higher is the firm embeddedness configuration i.e. degree centrality.

Figure 1 shows the sociogram with embeddedness attribute based on degree centrality in contract ties. In Figure 1, the researcher found a distinct core-periphery structure made up of several overlapping clusters. For example, the core actor in the sociogram i.e., the APMMHQ-1, is also the node or firm with the highest embeddedness configuration score. On top of that, APMMHQ-1 is moreover observed to be connected to other core actors of the network in other clusters such as WILSEL-12. APMMHQ-1 was also observed to be connected to other core nodes of another cluster, specifically WILUTA-4, in the sociogram. WILSEL-12 (which is central in the clusters) also possessed one of the highest embeddedness scores. In addition to that, the periphery network members who appear to be distant in the networks represent the nodes or firms which attained either medium or low scores. For example, PMMRSNG-17 is one other periphery node of the network in the APMMHQ-1 supply system which possessed a low embeddedness score. Similarly, DMKBALU-33 and DMTAWAU-35 are also periphery nodes in network and possess low and medium embeddedness scores.

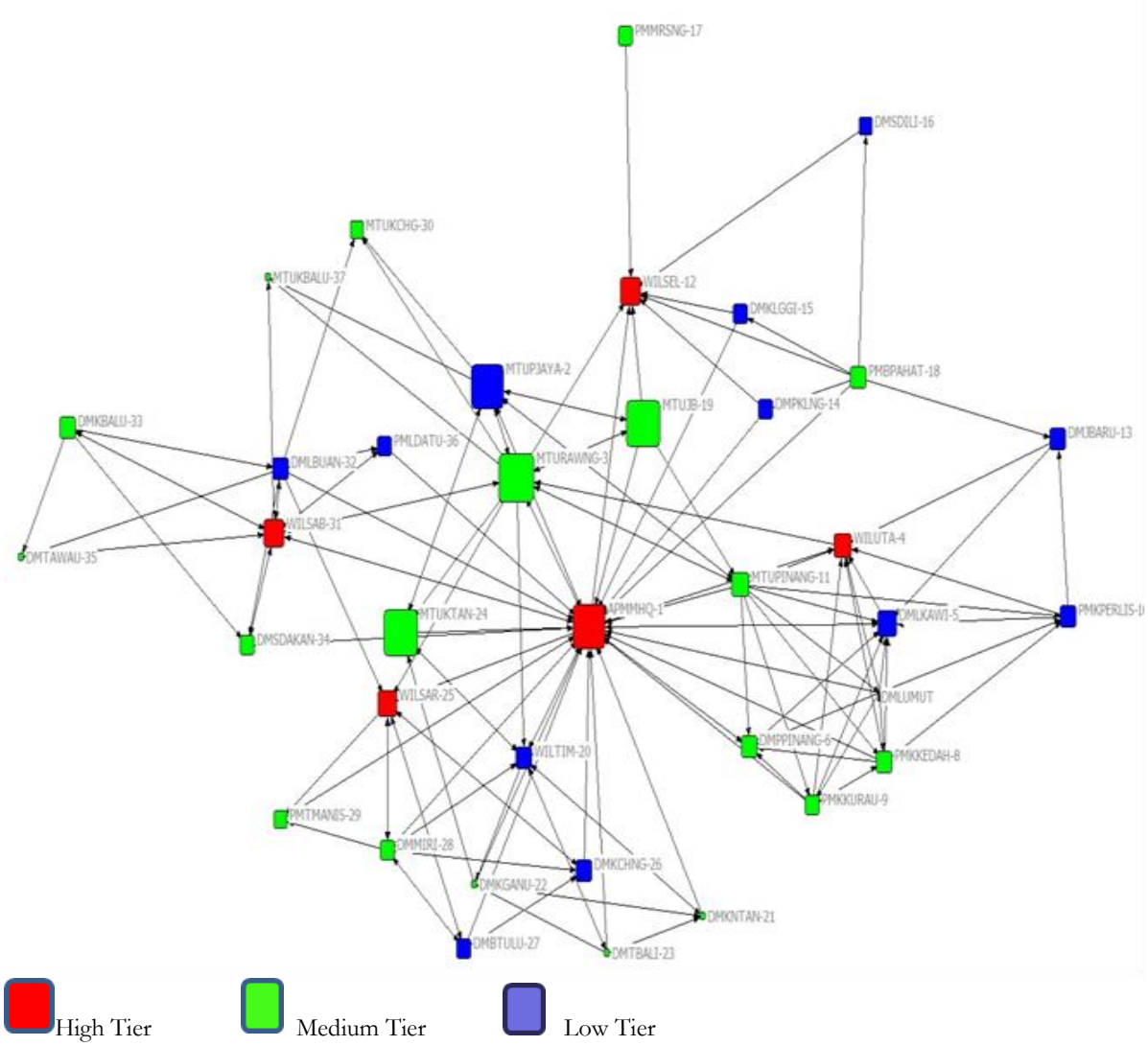


Figure 1 Supply network with color on the nodes representing tier level and node size representing the degree centrality scores in the contract tie

Figure 2 shows the sociogram with embeddedness attribute based on degree centrality in information-sharing ties. From an overall perspective, Figure 2 shows that the greatly embedded firms in the information-sharing tie are also largely among the central nodes in the supply system. For example, APMMHQ-1, WILSAB-31, MTUPJAYA-2, WILSEL-12, and WILUTA-4 are among the firms that are considered very central by other firms (red color). The size of the nodes also indicates that they are among the most highly-embedded based on degree centrality in the information-sharing tie. In addition to that, nodes that rated in low tier also exhibit low embeddedness scores based on degree centrality in the information-sharing tie. These firms include: DMTAWAU-34, DMKBALU-33, MTUKBALU-37, MTUKCHNG-30, PMMRSNG-17, PMKKURAU-19, DMKKNTAN-21, DMKGANU-22, DMMIRI28, MTUKTAN-24, and DMSDAKAN-22 respectively.

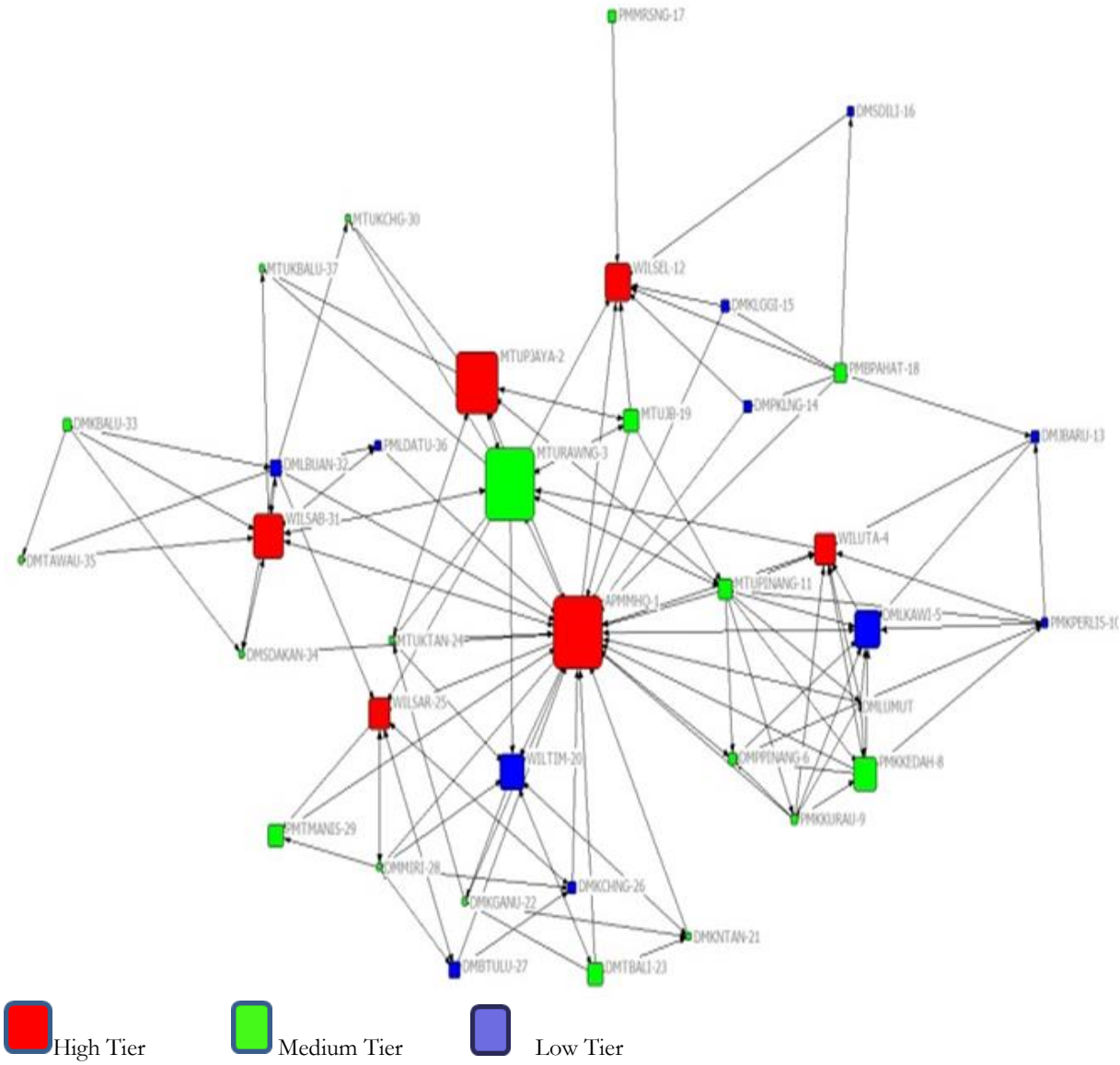


Figure 2 Supply network with color on the nodes representing tier level and node size representing the degree centrality scores in the information sharing tie

Structurally, this study found one intriguing finding of how highly embedded nodes in the information-sharing tie may not be among the highest in the supply tier, i.e., the MTURAWNG-3. This phenomenon may be because the information-sharing is considered to be an informal form of ties that are forged without any sets of rules or terms, such as in contractual ties. In contractual ties, when there is a set of terms or rules governing the relationships, the firm may tend to forge ties with others that have more resources (such as materials). On the other hand, in the information-sharing ties, the connection between the firms is formed without any rules or regulations governing its informal nature.

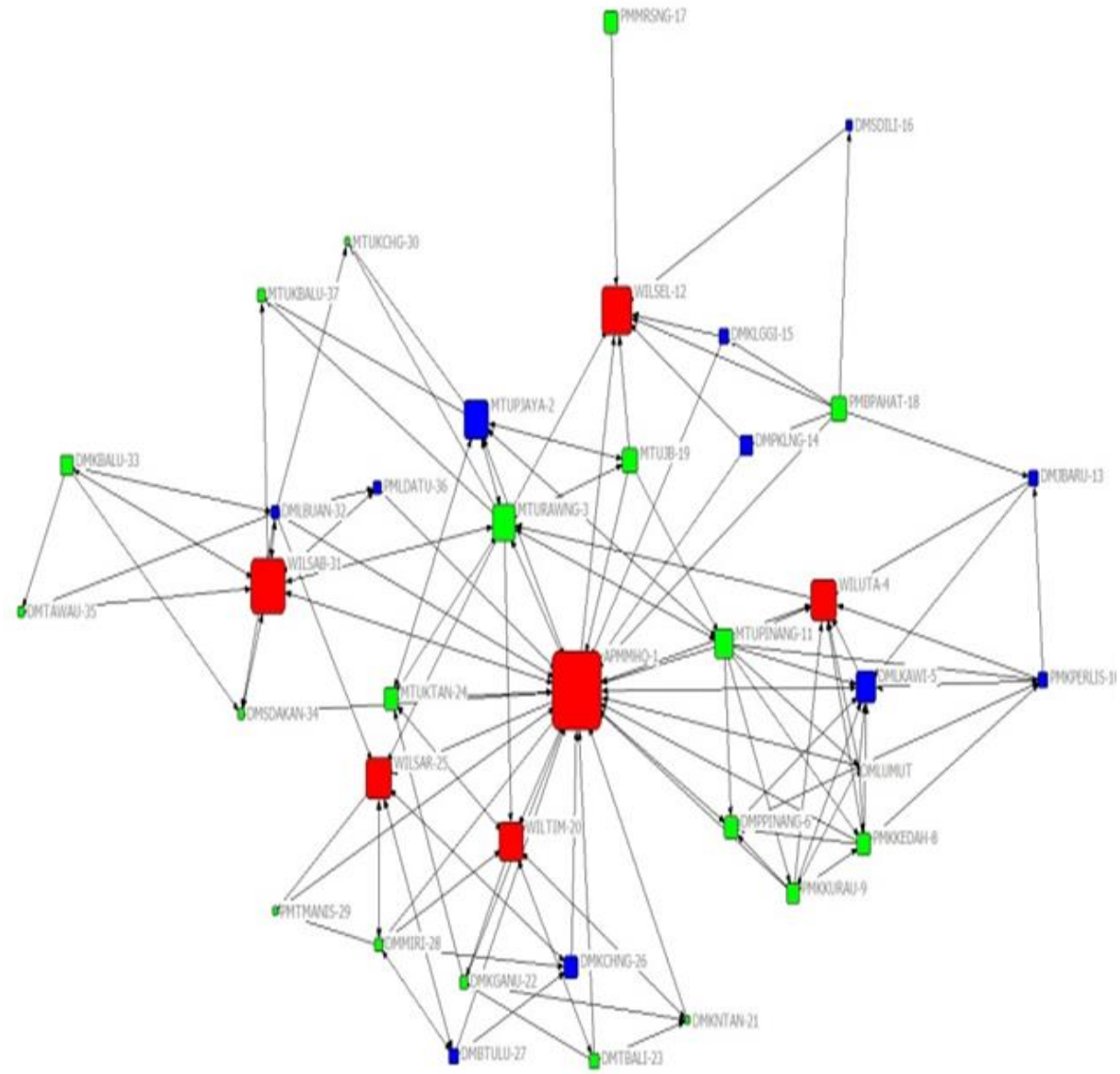
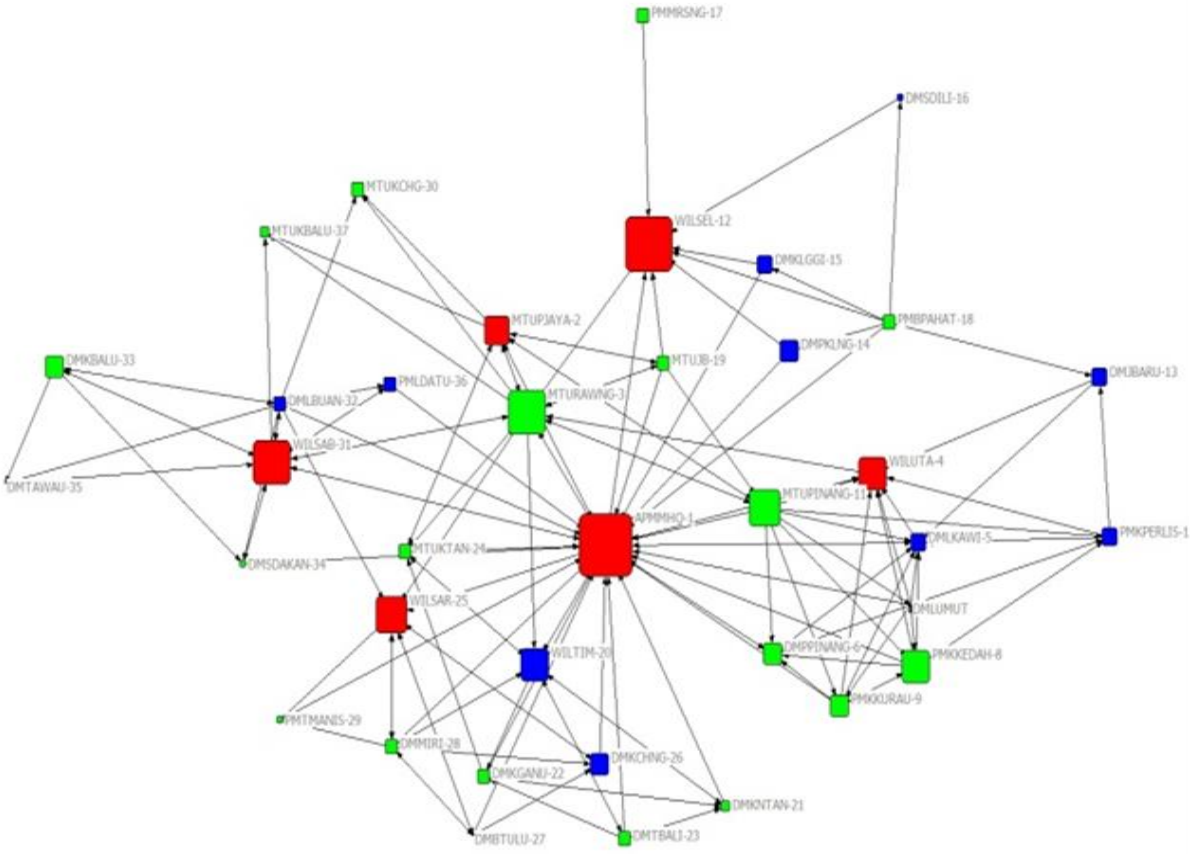


Figure 3 Supply network with color on the nodes representing tier level and node size representing the degree centrality scores in referral made tie.

Figure 3 shows the sociogram with embeddedness attribute based on degree centrality in referral made ties. In panel three, it is evident that greatly embedded firms having referral made ties are among the most valued in the network. For example, APMMHQ-1, WILSAB-31, WILSEL-12, and WILUTA-4 are the firms that are very connected with

others. The size of the nodes also indicates that they are among the most highly-embedded based on degree centrality in the referral made tie. In addition to that, nodes that are lowest in their tier score equally important exhibit a low embeddedness score based on degree centrality in the referral made tie. These firms include: DMTAWAU-34, DMKBALU-33, MTUKBALU-37, MTUKCHNG-30, PMMRSNG-17, PMKKURAU-19, DMKKNTAN-21, DMKGANU-22, DMMIRI28, MTUKTAN-24, and DMSDAKAN-22. Structurally, the highly embedded entities are basically the core nodes in the clusters of the supply network. For example, WILSAB-31 is the core firm in the WILSAB-31, DMLBUAN-32, DMSDAKAN-34, PMLDATU-36 cluster; APMMHQ-1 is the core firm in the APMMHQ-1, MTUKTAN-24 and WILTIM-20 cluster; WILSEL-12 is the core node in the WILSEL-12, DMPKLNG-14, DMKLGGI-15, and PMBPAHAT-18 cluster, and WILUTA-4 is the core firm in the WILUTA-4, DMLKAWI-5, DMPPINANG-6, DMLUMUT-7, PMKKEDAH-8, PMKKURAU-9, and MTUPINANG-11 cluster. Overall, Figure 3 indicates those firms that are greatly embedded in the referral made tie based on degree centrality attribute are.



High Tier Medium Tier Low Tier

Firm criteria: Degree centrality

Figure 4 Supply network with color on the nodes representing trust score and node size representing the degree centrality scores in referral received tie.

Figure 4 shows trust network with embeddedness attribute based on degree centrality in referral received ties. In Figure 4, the highly embedded firms also positioned high in the network tier. For example, APMMHQ-1, WILSAB-31, MTUPJAYA-2, WILSEL-12, and WILUTA-4 are among the firms that are most high by the tier standards. The size of the nodes also indicates that they are among the most highly-embedded based on degree centrality.

The visual analysis in Figures 1, 2, 3, and 4 reveals interesting findings in terms of prominent structural forms and the impact of involvement or embeddedness in formal versus informal supply ties.

Firstly, the researcher found that most firms having higher levels of tier in the formal tie, i.e. contract tie, do not necessarily materialize into firms high level of embeddedness configuration and vice versa. Although one highly embedded firm (APMMHQ-1) has high tier level, the visual analysis shows that other organizations (e.g. MTURAWNG-3, MTUJB-19, and MTKNTAN24) acquire lower embeddedness than others with lesser embeddedness or involvement scores (e.g. DMKCHNG-26, WILTIM-20, DMBTULU-29). However, in the informal tie network, the visual analysis also indicates that the majority of firms that have high embeddedness attribute scores based on degree centrality in information-sharing ties are equally important the nodes that are highly trusted in the network. Furthermore, it also indicates that firms with high levels of embeddedness attributes based on degree centrality in referral made ties, and referral received ties are also the firms that are considered trustworthy by other firms in the network.

This study draws attention to firms' embeddedness configuration of firms in the various types of relationships in a centralized supply network and the underlying impacts of these different network relations. More specifically, the researcher examined the relationship between a firm's levels of embeddedness, based on its network structural positions in the centralized supply network in the context of the ship building industry.

In the context of a centralized upstream supply network inter-firm relationship, it can be seen that related parties in the network of relationships encounter conflicts through goal incongruence and suspicions of asset abuse. Similarly, where a party considers it has been unfairly treated by another party, there will be a higher chance of a more complex supply network resulting from these inter-firm relationships. Organizational study scholars such as Powell (1996) and Putnam (1998) have proposed the adoption of a network form of organizational governance. They posit that this is an acceptable means to the inter-firm relations complexity as it can create numerous relational capital outcomes, such as trust, influence and reputation. Further, it can also contribute to an increase of competitive advantage and economic performance in the context of decentralized network structure to the firms embedded in the network structure.

Consequently, the researcher addressed the issue of inter-firm relationships in the centralized supply network by investigating the pattern of firm embeddedness through its network structural positions in the four types of inter-firm relations. It was evident to the exploratory network analysis of the network maps and network embeddedness measures that firm embeddedness in the centralized upstream supply network was related to the degree of formality of the network tie.

The results found in the exploratory network analysis regarding the relationship of firm embeddedness and the formality or informality of the tier coordination mechanism indicate a different stance compared to the traditional view of embeddedness that the embeddedness depends upon the strength of the multiple ties (Uzzi 1997).

The difference between the perspectives of embeddedness found in this study, and the traditional perspective of embeddedness begs the question of how can these divergences be elucidated. If anything, what is fundamentally different about the centralized upstream supply network from the voluntarily formed network structure, i.e. the decentralized network structure that could account for these diverse findings? The explanation that the researcher

provides here will focus on the unique form of the firms and the dynamics of the centralized upstream supply network.

Using exploratory network analysis, the researcher first developed the network maps of four network ties which are: the network contract tie, network information-sharing tie, network referral made tie and network referral received tie in order to determine the network embeddedness pattern of the four ties. This provides a general outlook of the supply network embeddedness structure. It is important to note that, in this analysis, based on earlier findings of organizational studies (Cousins et al., 2001); the four network ties are viewed on a continuum of tie's coordination (formal versus informal relations).

Findings of embeddedness configuration (centrality) both supported and were in line with the research question developed for this study. Accordingly, the following argument were discovered, discussed and applied to answer research question of this study.

The argument relates to the pattern of embeddedness of firms based on the types of network relations. In the context of the centralized supply network structure, firms were found to be more embedded or involved in network relations that require fewer formal coordination approaches than in the network relations that were formally managed through terms and regulations. An example of this is the contract tie, as evidenced through the increased level of connectivity among firms shown in Figure 1 (contract tie network map), Figure 2 (information-sharing tie network map), Figure 3 (referral made tie network maps) and Figure 4 (referral received tie network map).

5. Conclusion

The results of the exploratory network analysis conformed to similar findings in the literature. For example, Polanyi (1957) posited that the embeddedness of economic actions was supplemented by market approach in the post-industrial societies. In addition, Granovetter (1985) reiterated this position in his study, wherein the author posited that all economic actions were embedded in networks of social relations. Following that, Uzzi (1997) found that in the apparel business, although contracts govern the transactions between firms, the author found that firms rely most upon the web of social exchanges.

The finding of the exploratory network analysis adds to the views of Polanyi (1957), Granovetter (1985) and Uzzi (1997). Similar to these authors, this study found that, at least in the APMMHQ-1 supply network for RHIB; formal coordinative relations (such as the contract tie) only represent a small part of the actual interaction that exists in the upstream supply network structure. It was also determined that the other (or maybe the larger) portion of the network economic action is transmitted through a network of social relations.

Base on the findings of the network maps and the statistical results of network structural measures of embeddedness, the network plots and network structural measures indicate that in informally integrated ties, firms are more involved or embedded in the informal network structure than in formal ones. Thus, this would suggest that firms' embeddedness in the centralized supply network differ based on the different types of inter-firm relations.

This study is significant as firms contributed a lot of resources in managing its communication with members of its network. With this findings, firms are given the exploratory evidence of the impact of difference patterns of connectivity, thus giving the firms tool to strategically evaluate and developed a holistic resource allocation straegies. In addition to that, the finding of this research added to the body of knowledge of system theory as it identify the importance of difference form of connections in the system such as the supply network. Future research should attempt to statistically determine the relationship between the embeddedness of firms and its overall performance.

6. Acknowledgement

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7. Biodata

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